BIOLOGICAL EVALUATION
SPRUCE BUDWORM INFESTATIONS
Egg Mass Sampling
1961

Carson and Santa Fe National Forests and Adjacent
Private Land and Navajo Indian Reservation

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This report summarizes the 1961 egg mass survey findings. Egg mass sampling was started this year on August 7 when the eggs were about 50 percent hatched and concluded on September 8. Egg masses were counted on 27 plots scattered throughout more than one million acres of infested type. Prediction of the 1962 population level and ensuing damage is based on the results of the 1961 spruce budworm larval and damage surveys.[1/]

In general egg mass abundance has decreased from last year but remains at a level which will result in moderate defoliation of new growth. Conditions appear to be improving on the western division of the Santa Fe National Forest where for the third consecutive year egg mass abundance has decreased -- in 1959, 27.7 egg masses per 1000 square inches of foliage were recorded; in 1960, 21.4; and in 1961, 15.2. Egg parasitism increased appreciably over last year and may be responsible for the overall decrease in the number of new egg masses.

In 1955, about 371,000 acres of national forest land in north-central New Mexico were treated to control the spruce budworm. Since 1956 the budworm infestations, based on ground and aerial surveys, have increased in acreage in Region 3 as follows:

1956 ----	35,520	1959 ----	619,920
1957 ----	62,620	1960 ----	760,000
1958 ----	205,120	1961 ----	1,109,660

1/ Chansler, J. F. Biological evaluation, spruce budworm larval densities and damage surveys, 1961. Carson and Santa Fe National Forests.

The loss of current Douglas-fir foliage averaged 35 to 45 percent (moderate defoliation). But as in the past, defoliation of true firs was more severe. In areas defoliated annually for the past several years top-killing and tree mortality is severe.

TECHNICAL INFORMATION

Causal agent: Spruce budworm, Choristoneura fumiferana (Clem.)

Host trees: Douglas-fir, Pseudotsuga menziesii var. glauca; white fir, Abies concolor; corkbark fir, Abies arizonica; blue spruce, Picea pungens; and Engelmann spruce, Picea engelmanni. In New Mexico damage is confined for the most part to Douglas-fir and the true firs.

Type of damage: Although mostly moderate current defoliation was observed during the ground damage survey, a great portion of the area was classed as heavy from aerial observations because of accumulated damage. Degree of accumulated defoliation increased in all categories in 1961. Dying true fir and top-kill in Douglas-fir is becoming noticeable throughout the infestations.

Environmental factors: No unusual environmental factors are known to be associated with the outbreak.

Extent and location of outbreak: Approximately one million acres of mixed conifer forest on federal, Indian and private lands exhibit varying degrees of damage. In 1961, a heavy northeast migration was recorded on private land east of the Carson National Forest. Areas infested are delineated on the attached maps. Acreage and degree of accumulated defoliation are summarized in table 1.

BIOLOGICAL EVALUATION

Sampling: The same plots and in most cases the same trees were used to sample egg mass density in 1961 as in 1960 (table 2). Four plots were on the Navajo Indian Reservation and 23 were on the Carson and Santa Fe National Forests and adjacent private lands. A plot consisted of five codominant Douglas-fir trees. Two white fir plots were taken in 1960 but were deleted in 1961. Two men using an 18-foot aluminum extension ladder sampled infested trees by removing two lower mid-crown branches. The foliage on one side of each branch was stripped off and discarded; this, in effect, amounted to one whole branch per tree or five whole branches per plot. The gross area of the remaining foliage on each limb was measured then clipped and placed in numbered plastic bags. The foliage was taken to Taos, New Mexico, and examined for egg masses by four biological aides.

ble 1.--Acreage of spruce budworm infestations in northern New Mexico by degree of accumulated defoliation, 1961.

Location	Degree of defoliation 1/				Totals	
	Light	Moderate	Heavy	Very Heavy	Federal	Private
Carson N.F., Eastern Division & adjacent land						
Forest Service	27,520	90,880	74,880	10,240	203,520	
Picuris Grant	3,200	640	0	0	3,840 2/	
Rancho Del Rio Grande	2,560	33,920	35,840	480	72,800 3/	
Rosario Grant	0	1,120	320	0		1,440
Maxwell Grant	23,680	95,360	1,280	0		120,320
Mora Grant	6,400	39,680	0	0		46,080
Carson N.F., Western Division & adjacent land						
Forest Service	20,640	28,960	12,160	480	62,240	
Tierra Amarilla Grant	11,520	9,280	57,600	12,800		91,200
Santa Fe N.F., Western Division & adjacent land						
Forest Service	135,940	34,240	4,480	0	174,660	
Baca Location	64,400	18,400	960	0		83,760
Canyon De San Diego	12,960	0	0	0		12,960
Santa Fe N.F., Eastern Division						
Forest Service	97,280	38,080	16,160	5,440	156,960	
Subtotals	406,100	390,560	203,680	29,440	674,020	355,760
Navajo Indian Reservation	34,120	35,200	10,560	0	79,880 2/	
Grand Totals	440,220	425,760	214,240	29,440	753,900	355,760

1/ Defoliation categories are Light, defoliation barely visible from the air; Moderate, top one-fourth of tree defoliated; Heavy, one-half of tree defoliated, top-killing in progress; and Very Heavy, three-fourths of tree defoliated, tree killing in progress.

2/ Indian land - federal.

3/ Recently acquired by the Forest Service.

RESULTS

Egg mass densities: New egg masses per 1000 square inches of foliage have decreased again this year on the infested areas in New Mexico. Even with this decrease the egg mass densities remained relatively high. Infested areas on the Carson, the eastern division of the Santa Fe, and adjacent private lands will receive moderate to heavy defoliation of new growth in 1962. Infested areas on the western division of the Santa Fe National Forest and the Navajo Indian Reservation will be lightly to moderately defoliated. Damage predictions for individual plots are based on 1961 biological evaluations. Table 3 summarizes the number of new unparasitized egg masses for the years 1959, 1960 and 1961.

Egg parasitism: Parasitism of eggs by Trichogrammum minitum Riley in north-central New Mexico nearly doubled this year and was an important cause in the overall decrease in the number of new egg masses. Although the egg parasite is generally not considered of great importance[2/] its role in the natural control complex cannot be overlooked. This year, for example, it destroyed nearly 13 percent of the eggs before hatching occurred.

DISCUSSIONS AND CONCLUSIONS

Defoliation on all plots in 1961 ranged from light to heavy, with most plots classified as moderate. The effect of accumulated defoliation keeps much of the infested area in poor condition. Damage to the true firs in the mixed conifer type is severe and in many areas is leading to extreme mortality. Accumulated damage to Douglas-fir and spruce is resulting in tree deformation and increment losses. Not only is the harvestable crop being damaged but loss of advanced reproduction of all host species is occurring in many areas.

A noticeable reduction in egg masses was recorded on the western division of the Santa Fe National Forest for the third consecutive year (table 3). Factors responsible for this are not known. For other areas the level of budworm population, as determined from the egg mass sampling, remains static.

In 1962 moderate defoliation of new growth is expected over most of the infested area on the Carson and Santa Fe National Forests and adjacent private and Indian lands and the Navajo Indian Reservation. Tree-killing and top-killing will increase because of the accumulated effect yearly budworm feeding has on its host. Suppression of the budworm population is necessary if present and future timber values are to be protected in northern New Mexico.

2/ Miller, C. A. 1953. Parasitism of spruce budworm eggs by Trichogrammum minitum Riley. Can. Dept. Agr. Bi-mon. Progress Report 9(4).

Table 2.--Summary of spruce budworm egg mass counts from 27 Douglas-fir plots, national forests, private and Indian land in northern New Mexico, 1961.

Plot Location	Sq. in. of foliage examined 1961	No. of egg masses per 1000 sq. in. of foliage - 1961		Predicted damage level of new growth
		New	Para.	
Carson N.F., Eastern Division & adjacent land				
Pot Creek	8,152	21.3	4.6	M-L
La Junta Canyon	7,709	11.1	5.0	L
Comales Creek	7,855	42.1	4.5	H-M
Picuris Peak	7,173	25.3	5.4	M
La Jara Canyon	7,085	35.8	2.7	M
Pueblo Canyon	7,634	46.9	2.7	H
Taos Canyon	9,658	32.9	3.7	M
Chiquito Canyon	6,125	22.1	7.8	M-L
Polio Carpio Canyon	9,309	20.8	3.6	L-M
Santa Barbara Campground	6,046	23.7	2.0	M
Garcia Park	9,170	19.1	4.3	L-M
Subtotal	85,916	301.1	46.3	
Subaverage	7,811	27.4	4.2	M
Carson N.F., Western Division & adjacent land				
Lobo Lodge	7,072	46.8	18.7	H
Brazos Box	7,460	25.0	0.9	M
Willow Creek	7,989	42.0	2.5	H-M
Canones Creek	10,441	26.5	10.5	M
Broke Off Mountain	5,753	40.4	1.6	H-M
Rio Nutritas	6,772	42.2	6.2	H-M
Subtotal	45,487	222.9	40.4	
Subaverage	7,581	37.2	6.7	M-H
Santa Fe N.F., Western Division & adjacent land				
Paliza Canyon	7,292	23.6	0.3	M
Del Norte Canyon	9,528	4.4	0.3	VL
Clear Creek	7,481	6.6	0.1	VL
Bluebird Mesa	6,807	7.6	0.2	L
San Pedro Mountains	7,479	24.4	0.2	M
Red Top	6,176	24.5	2.0	M
Subtotal	44,763	91.1	3.1	
Subaverage	7,461	15.2	0.5	L-M
Grand Total	186,166			
Grand Average	8,094			

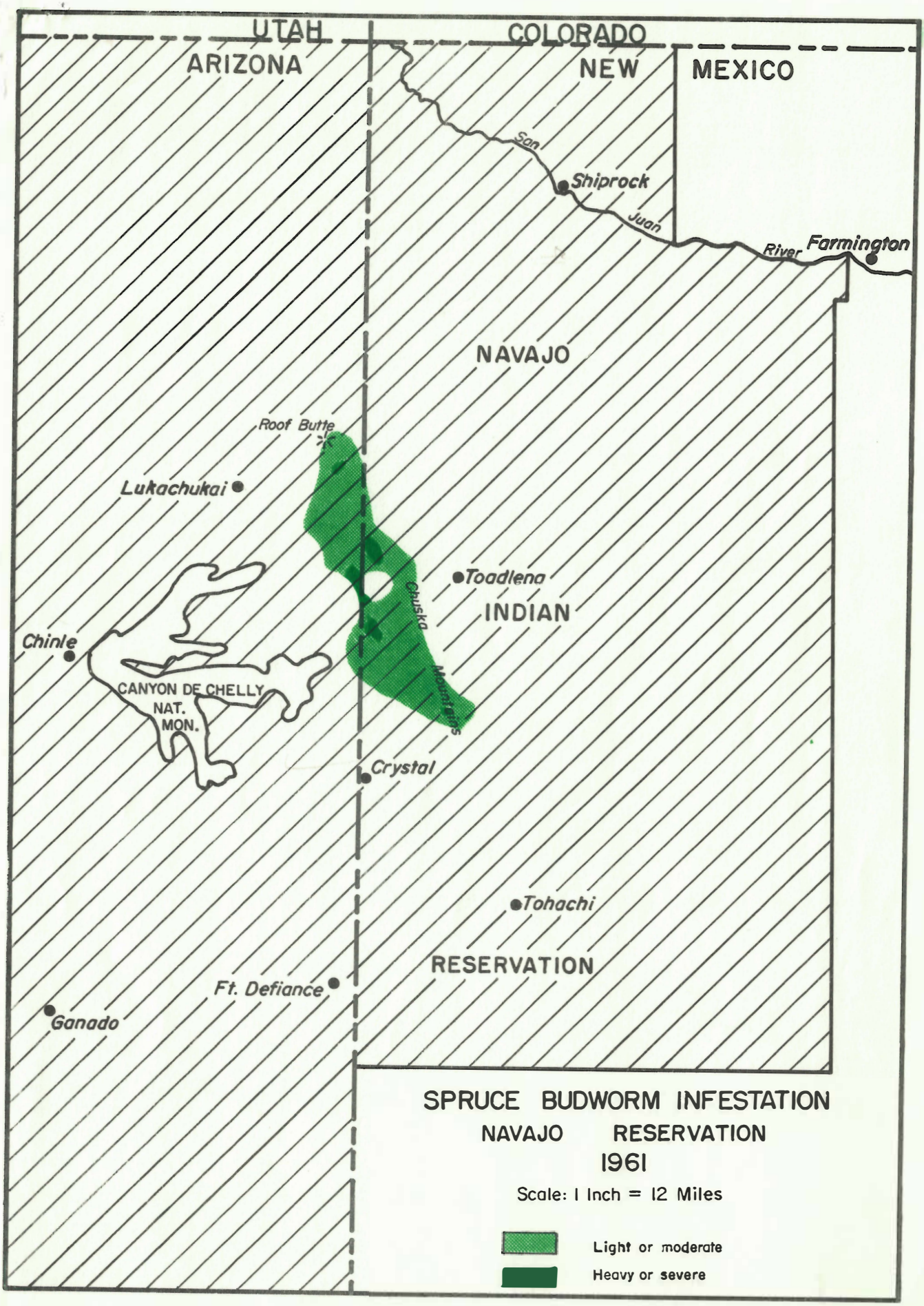
Table 2.--continued

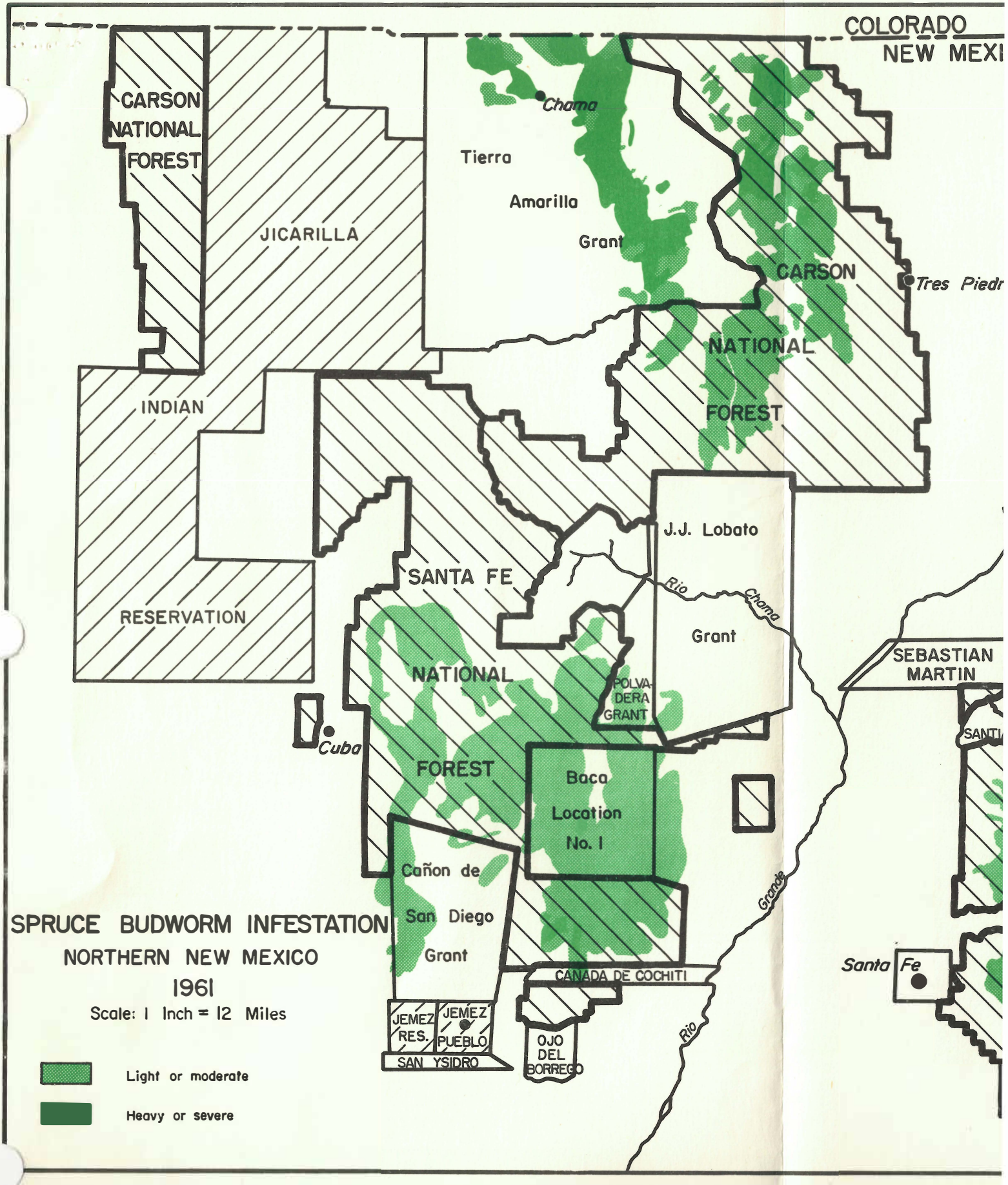
Table 2.--Continued.

Plot Location	Sq. in. of foliage examined 1961	No. of egg masses per 1000 sq. in. of foliage - 1961: New	Para.	Predicted damage level of new growth
Navajo Indian Reservation				
Washington Pass	6,955	25.3	5.4	M
Toadlena	10,172	19.7	0.2	L-M
Burn	7,477	24.5	0.4	M
Roof Butte	12,293	22.0	0.8	M-L
Total	36,897	91.5	6.8	
Average	9,224	22.9	1.7	

Table 3.--Summary of new unparasitized egg masses by entomological units for 1959, 1960, and 1961.

Entomological Unit	Average number of new unparasitized egg masses per 1000 sq. inches of foliage		
	1959	1960	1961
Carson N.F., Eastern Division and adjacent private land	49.0	31.4	27.4
Carson N.F., Western Division and adjacent private land	18.4	35.3	37.2
Santa Fe N.F., Western Division and adjacent private land	27.7	21.4	15.2
Navajo Indian Reservation	---	33.9	22.9


UTAH
COLORADO
ARIZONA
NEW
MEXICO
San
Juan
River
Shiprock
Farmington
NAVAJO
Roof Butte
Lukachukai
Toadlena
INDIAN
Chuska
Mountains
Chinle
CANYON DE CHELLY
NAT.
MON.
Crystal
Tohachi
RESERVATION
Ft. Defiance
Ganado
SPRUCE BUDWORM INFESTATION
NAVAJO RESERVATION
1961
Scale: 1 Inch = 12 Miles
Light or moderate
Heavy or severe


COLORADO
NEW MEXI
CARSON NATIONAL FOREST
JICARILLA
INDIAN
RESERVATION
Chama
Tierra
Amarilla
Grant
CARSON
NATIONAL
FOREST
Tres Piedr
SANTA FE
NATIONAL
FOREST
J.J. Lobato
Rio Chama
Grant
POLVA-
DERA
GRANT
Cuba
Baca
Location
No. 1
Cañon de
San Diego
Grant
CANADA DE COCHITI
JEMEZ
RES.
JEMEZ
PUEBLO
SAN YSIDRO
OJO
DEL
BORREGO
SEBASTIAN
MARTIN
Rio Grande
Santa Fe
SPRUCE BUDWORM INFESTATION
NORTHERN NEW MEXICO
1961
Scale: 1 Inch = 12 Miles
Light or moderate
Heavy or severe